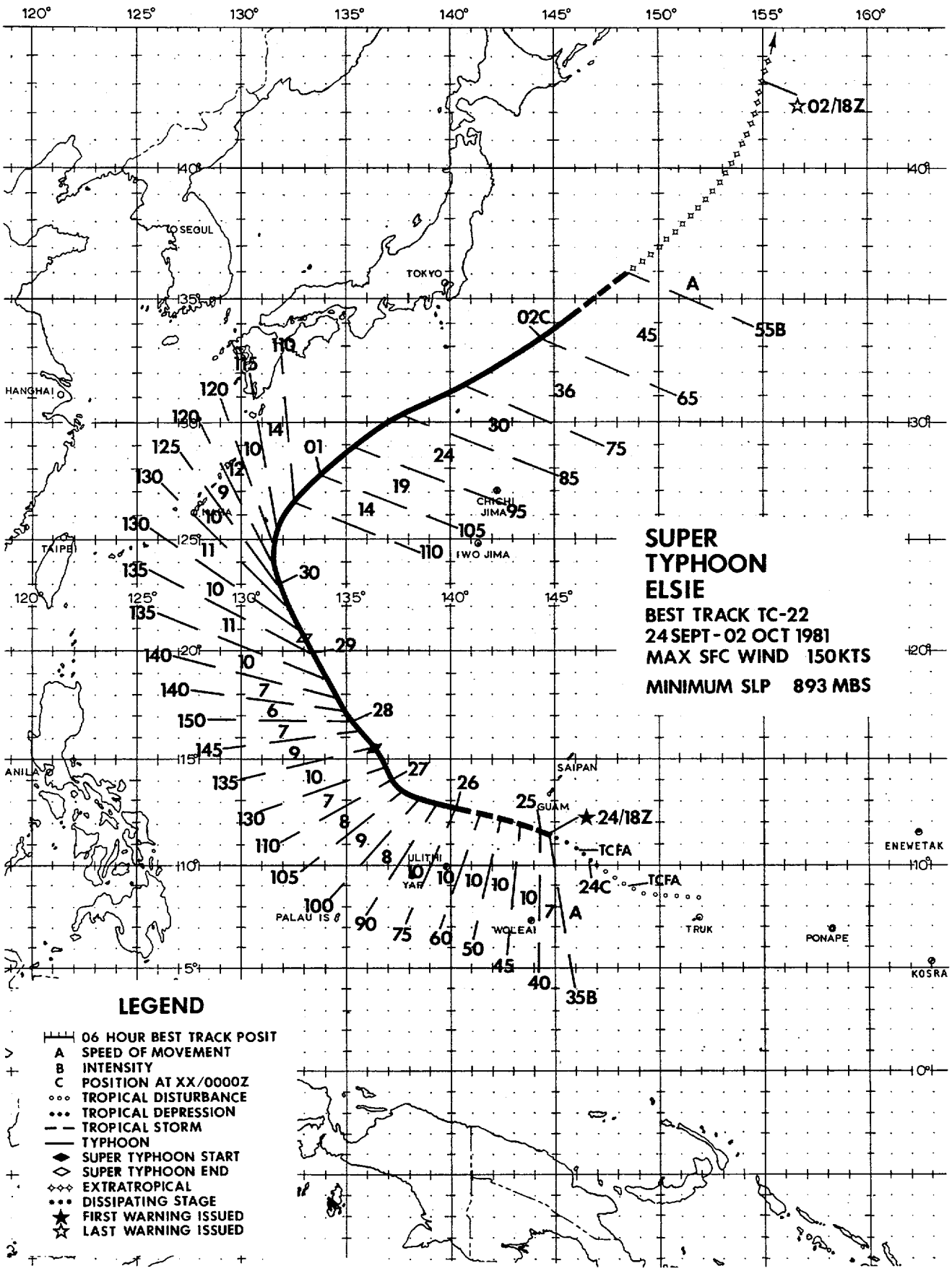
SUPER
TYPHOON
ELSIE
BEST TRACK TC-22
24 SEPT - 02 OCT 1981
MAX SFC WIND 150 KTS
MINIMUM SLP 893 MBS
☆02/18Z
★24/18Z
TCFA
TCFA
SAIPAN
GUAM
ULITHI
YAP
WOLEAI
PALAU IS
TOKYO
SEOUL
TAIPEI
ANILA
HANGHAI
CHICHI JIMA
IWO JIMA
TRUK
PONAPE
KOSRA
ENEWETAK
LEGEND
06 HOUR BEST TRACK POSIT
A SPEED OF MOVEMENT
B INTENSITY
C POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
DISSIPATING STAGE
FIRST WARNING ISSUED
LAST WARNING ISSUED

Following the northward progression of Typhoons Clara (20) and Doyle (21), the near equatorial trough became very weak and diffuse with very few areas of concentrated convection during 19 and 20 September 1981. By 210600Z two areas of significant convection, one near 10N 170E and the other near 5N 155E, signaled the re-establishment of substantial activity. The signal, however, appeared to be false, as convection along the trough dropped dramatically during the subsequent twenty-four hours. One small convective area, approximately one degree in diameter, remained near 8N 150E at 220600Z and surface/gradient level wind data at 220000Z identified a weak but well defined associated circulation. At 230700Z an initial Tropical Cyclone Formation Alert (TCFA) was issued for this convective area following further definition of the disturbance by satellite data which showed a fairly well organized upper-level anticyclone (ULAC) located above the low-level circulation. This action was taken despite the failure of aircraft reconnaissance to find anything significant. A second TCFA was issued at 240700Z, following a more successful aircraft reconnaissance mission which did locate the low-level circulation. Continued improvement of the satellite image, supported by the aircraft findings, culminated in the issuance of the first warning on TD-22 at 241800Z.

In retrospect, Elsie (Fig. 3-22-1) was a very well behaved cyclone. The major pro-

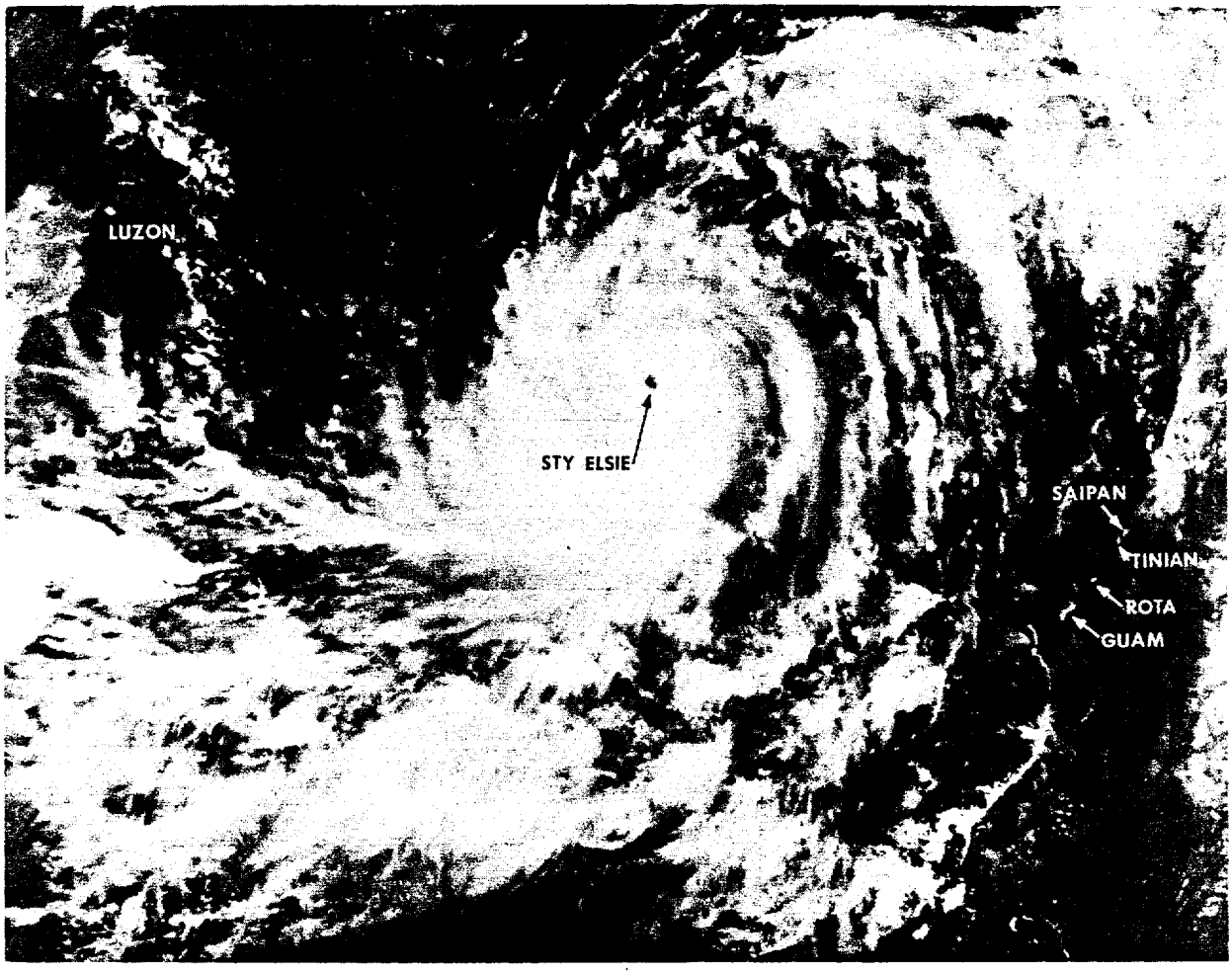

Figure 3-22-1. This 280520Z satellite photo shows Super Typhoon Elsie just after reaching a peak intensity of 150 kt (77 m/sec). At this time Elsie was located 615 nm (1139 km) west-northwest of Guam. (NOAA 7 visual imagery)

blem faced by JTWC was one of timing the significant segments (Fig. 3-22-2) of Elsie's track, each of which represents a different response to the surrounding environment. The approach of this discussion will be to evaluate each segment of the track, the apparent forecast reasoning at the time, and the performance of the one way interactive tropical cyclone model (OTCM) in predicting progression into the next segment.

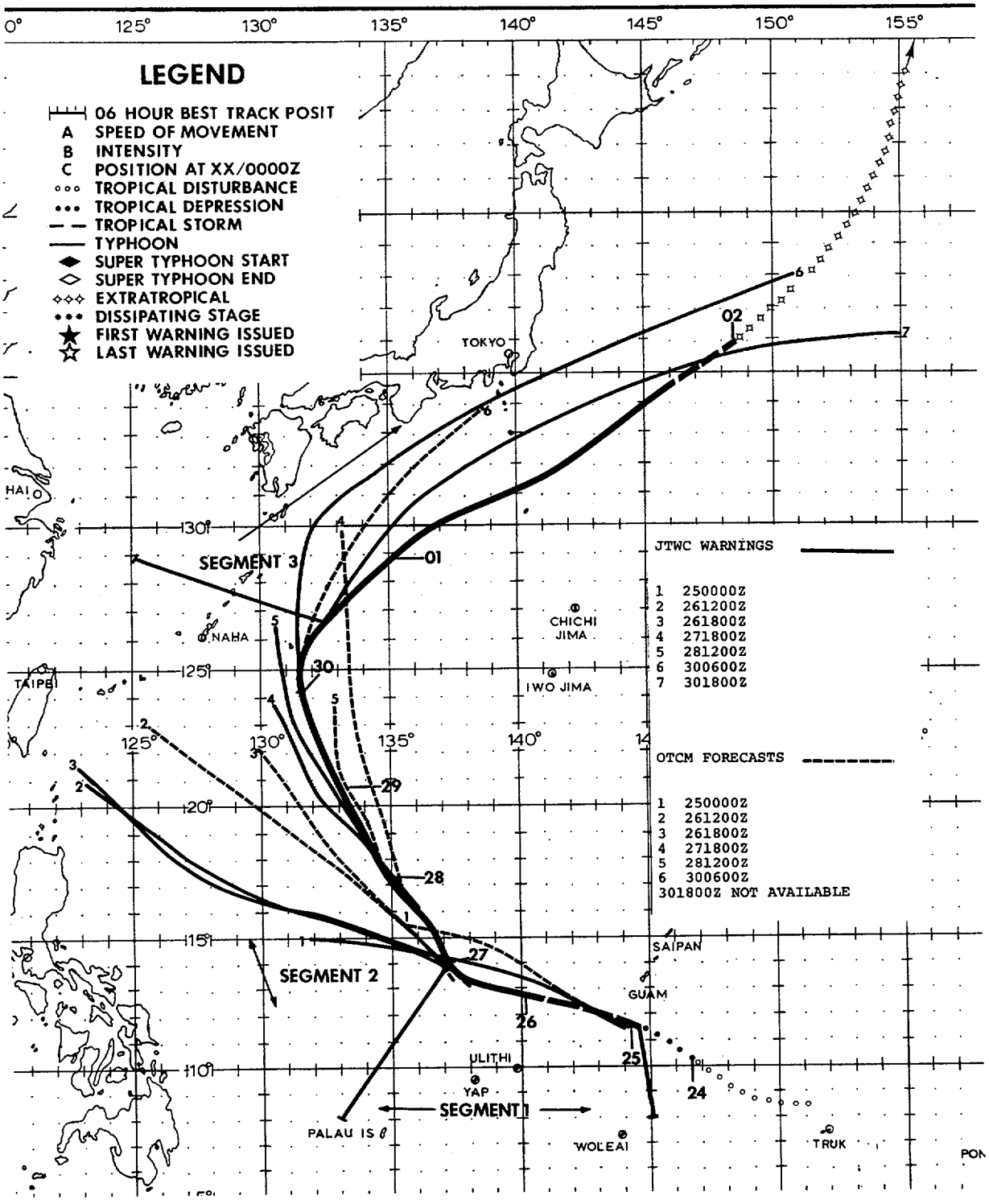

Figure 3-22-2. Elsie's best track overlayed with JTWC and OTCM forecasts. Forecasts illustrated here bracket significant changes in Elsie's direction of movement.

Segment #1 (241800Z - 261800Z Sep 81): During this period, which begins with the issuance of the first warning, the JTWC 500 mb analysis placed the subtropical ridge axis between 20N and 23N with no breaks along Elsie's predicted track. Analysis from Fleet Numerical Oceanography Center (FNOC) agreed on the placement of major 500 mb synoptic scale features. FNOC's 500 mb forecast built the ridge and the resultant OTCM predicted a west-northwest track. JTWC continued this forecast trend through warning No. 9, issued at 261800Z.

Prognostic reasoning bulletins were calling for an eventual shift toward a more northward track, however timing was the big factor. JTWC's analysis showed the building of the ridge; aircraft reconnaissance tracks north of Elsie continued to yield support to the JTWC forecast. FNOC's forecast did predict movement of a major 500 mb trough eastward over Japan. Height falls associated with this trough showed up on JTWC analysis at 260000Z, coincident with the appearance of a break in the ridge near 20N 135E, a position northwest of Elsie's 500 mb cyclone. The break was most likely induced by the trough to the north and the presence of Elsie to the south of the ridge.

Interestingly, the OTCM made its first change in track at 261200Z by suggesting a more northwestward track. By 261800Z the OTCM had definitely locked into a northwest track, however, it was not until warning No. 13, at 271800Z, that JTWC's warnings relinquished west-northwest movement for the more northwestward track shown by the OTCM.

Segment #2 (270000Z - 301200Z): FNOC and JTWC analysis of 500 mb data, and support from aircraft reconnaissance, continued to confirm the break in the ridge, which was fostered by the deep trough over Japan and Elsie's enlarging 500 mb circulation. Responding to this induced trough, Elsie began to track north-northwest for a period of 48 hours. JTWC forecasts through this segment of Elsie's life not only predicted the movement trend well but also predicted transition into the next segment of Elsie's track, the recurve.

Warning No. 16, issued at 281200Z, represented the first warning that truly fits the segment 2 profile and predicted the change of track to segment 3. FNOC analysis and forecasts, as well as the JTWC analysis, defined the synoptic pattern extremely well, such that the JTWC forecasts were very consistent in their call for recurvature. Post-analysis has shown that in anticipating a recurve, JTWC's forecasts were conservative when compared with the OTCM and the actual storm best track. The conservatism of JTWC was based on the belief that the weak 500 mb winds (15-20 kt (8-10 m/sec)) south of Japan would allow Elsie to penetrate further north before encountering westerlies sufficiently strong enough to cause deflection northeastward. FNOC forecasts also showed no major trough movement at 500 mb that might lend support to any other forecast track. In fact, FNOC forecasts generally favored development of a zonal flow over Southern Japan. OTCM forecasts also drove Elsie northward toward Japan.

FNOC forecasts of a trough moving eastward off Asia did not indicate deepening, thus the most representative forecast was toward Japan. However, significant deepening did occur; the OTCM forecast for 300600Z Sep (Warning No. 23) was the initial indicator of this influence on the forecast track. JTWC's forecasts had predicted the recurve all along, but now began to converge on a tighter recurve pattern and finally stablized, by warning No. 25, at 301800Z Sep.

Segment #3 (301800Z - 020500Z Oct 81): This portion of the storm track began with Elsie accelerating rapidly northeastward and ended with extratropical transition. The FNOC forecasts, once they picked up the trough, deepened it significantly, as analyses at JTWC and FNOC eventually bore out. Elsie accelerated up the leading edge of the trough and by 020600Z had transitioned into an extratropical system. It is instructive to note that not until warning No. 30, issued at 020000Z, did JTWC make its final track change and forecast the disturbance to move north-northeast, up the back of the ridge. The OTCM had predicted this track some twelve hours earlier at 011200Z.

JTWC warnings up to warning No. 30 continued with the northeast track thus sending the system through the ridge. The JTWC warnings that continued to forecast eastward movement did have sound basis, since Elsie's movement as indicated from satellite and aircraft data continued to be northeast. This movement also placed Elsie within a steering regime that, based upon 500 mb analysis and forecast, should have kept Elsie moving northeast. The problem was the result of sound forecast logic based upon a faulty prognostic chart series. The 500 mb forecast series failed to adequately handle an advancing trough and the rapid building of the ridge ahead of Elsie. Once these forecasts began to reflect the changes, the JTWC forecaster was faced with making a decision based upon two significantly different 500 mb patterns. The first was the consistency of the longer established forecast trend, with its near zonal pattern, and the second was the rather abrupt change to this pattern which was first suggested in the 36 hour 500 mb forecasts valid at 021200Z. The apparent radical change in 500 mb steering caused by the sudden deepening of the trough and amplification of the ridge was not "bought" by the Typhoon Duty Officer, the OTCM did however "buy" the change by 011200Z. This final track predicted by the OTCM was followed by Elsie through her extratropical transition and subsequent merger with mid-latitude, migrating systems.

The OTCM handled the final segment of Elsie's life quite well just as it did with the earlier stages. In summary, this single case study indicates that for this particular cyclone, the OTCM appeared to "sense" the environmental changes to which Elsie responded from 12-24 hours prior to them being reflected in the JTWC forecast.